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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/158,099	09/22/1998	KENJI MIWA	0163-0707-2X	3529

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EXAMINER
LIN, KUANG Y

ART UNIT	PAPER NUMBER
1725	

NOTIFICATION DATE	DELIVERY MODE
07/20/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	09/158,099	MIWA ET AL.	
	Examiner	Art Unit	
	Kuang Y. Lin	1725	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *15,18,20,21,23 and 25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15,18,20,21,23 and 25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 15, 18 and 20, 21, 23 and 25 insofar as definite are rejected under 35 U.S.C. 103(a) as being unpatentable over Vives

Vives discloses a grain refinement method for aluminum alloy (page 448, left col., last paragraph and right col., 4th complete paragraph) by applying an electric current and a magnetic field simultaneously (page 446, right col., 3rd complete paragraph and the junction paragraph between pages 447 and 448) to the molten aluminum alloy during a solidification process at temperature lower than a liquidus of the alloy (page 446, right col., last paragraph, page 447, right col., second complete paragraph and page 449, right col., 1st complete paragraph). Although he does not mention the feature of shifting a refined material to a

periphery of a container to yield the refined material concentrated in an end portion of the metallic material, apparently, his process will produce the same result as that of applicants since he performs the identical process steps as that of applicants. In short, Vives substantially shows the invention as claimed except that he does not show the container is in cylindrical shape. However, it would have been obvious to use the container of any configuration in the process of Vives depending on the designated metallic casting article to be obtained.

4. Claims 15, 18 and 20, 21, 23 and 25 insofar as definite are rejected under 35 U.S.C. 103(a) as being unpatentable over Radjai et al.

Radjai et al. substantially show the invention as claimed except that they do not show the shape of the container. However, it would have been obvious to use any shape of the container as long as it will confine the hyper-eutectic Al-SI alloys for performing the electromagnetic vibrations effect on the alloy during solidification process. With respect to claim 23, it would have been obvious to manipulate the process parameters to obtain the designated grain size through routine experimentation.

5. Claims 15, 18 and 20, 21, 23 and 25 insofar as definite **(assuming that Radjai et al do add particles to the molten metal)** are rejected under 35 U.S.C. 103(a) as being unpatentable over Radjai et al and further in view of Vives.

Radijai et al substantially show the invention as claimed and assuming that they do not disclose to crush solid crystals into small pieces during a solidification process at temperatures lower than the liquidus. However, Vives discloses two

distinct causes of grain refinement, represented by fluid flow and cavitation phenomena, in a solidifying liquid metal (see page 448, right col. last paragraph). In the absence of cavitation and for a sufficient intensity of the oscillating flow, the columnar-dendritic crystallization is replaced by a microstructure characterized by the formation of agglomeration of globular particles. On the other hand, when an alloy is solidified in the presence of well-developed cavitation situations, a very fine and homogeneous microstructure has been observed throughout ingot (see page 449, right col. second paragraph and page 454, left col. second paragraph). He also discloses that gas content in the liquid metal (see page 449, left col. second paragraph) and the intensity of magnetic pressure contributed to the cavitation phenomena (see page 449, left col. last paragraph through page 449, right col. last paragraph). It would have been obvious to manipulate the gas content of aluminum alloy and the magnetic pressure during the solidification process of Radjai et al in view of Vives such that to obtain well-developed cavitation situations in the molten metal at the temperature lower than the liquidus and thereby to better refine the grain structure. It would have been obvious to use the container of any configuration in the process of Vives depending on the designated metallic casting article to be obtained.

6. Applicant's arguments filed July 2, 2007 have been fully considered but they are not persuasive.

a. In page 5, 2nd paragraph and page 9, 2nd paragraph of the remarks applicant stated that in Vives the container is made of stainless steel and some of the electric current passes through vessel will be loss in producing Joule heat. However, the electric current flows to the path of least resistance. Since Aluminum alloy is more conductive than the stainless steel, minimal quantity of the current will flow through the stainless container. Thus, the loss will be minimum. Applicant stated in page 5, 2nd paragraph of the remarks that the shape and material of the vessel are very important element to generate the "shifting" and ceramics or glass is preferable as the material of the vessel, and the stainless steel is not preferable as the material of the vessel in this invention. However, there is no disclosure in the specification to set forth the fact.

b. In page 8, 3rd paragraph of the remarks applicant stated that Vives does not thoroughly examine the magnetohydrodynamic phenomena occurring during the test and they fails to disclose or suggest applicant's claimed step of "shifting the small pieces to a periphery of a cylindrical tube or container with the alternating current and the magnetic field." However, Vives does use the alternating current and the magnetic field to create cavitation phenomena during solidification of molten metal. The process is the same as that of instant application (see, for example, page 3, last paragraph of instant specification). Since the strength of current and magnetic in Vives is so large that it generates cavitation within the molten metal, it would expect that the small pieces in the solidifying molten metal will be shifted to the periphery of the container.

c. In page 8, 4th paragraph of the remarks applicant stated that in Vives the pinching force cannot be successfully generated since the molten metal sample is in a vessel having free surface. However, the pinching force is generated by the interaction between the magnetic field and the alternative current (see page 12, 3rd paragraph of applicant's remarks). Thus, the pinching force will be generated in the molten metal mass with or without the free surface. Further, in Figure 3 of the supplemental drawing, filed July 2, 2007, it shows a free surface in the top portion of the mold. Thus, the figure is anther evidence that the pinching force will be generated in the molten metal mass with or without the free surface.

d. In page 9, 2nd paragraph of the remarks applicant stated that the strength of the magnetic field in Vives is about 1/10 compared with that of the instant invention. However, the magnetic field used by Vives is 0.7 tesla and 3500 amp to generate a strong force to vibrate the solidifying melt (see, for example, left col. of page 448 and figure 7). Since the cavitation is generated in the molten metal mass, it is apparent that the strength of the current and the magnetic field must be great enough to crush the particles. It is a common knowledge that a greater force will be generated as the stronger magnetic field and greater magnitude of current are applied. It would have been obvious to apply a stronger magnetic field to the molten metal of Vives shall a greater force for generating a greater cavitation phenomena is designated. Thus, applicant's argument is moot.

e. In page 10, last paragraph through page 11, 2nd paragraph of the remarks applicant stated that in Vives the very fine and homogeneous microstructure has been observed throughout the ingot. However, in page 451, right col. 3rd paragraph of Vives, it discloses that the inhomogeneous structure is observed due to intensity variation of the cavitation.

f. In page 11, 2nd through 4th paragraphs of the remarks applicant stated that the shape and the material of the container or vessel are very important element to generate the shifting. However, the pinching force is generated by the interaction between the magnetic field and the alternative current (see page 12, 3rd paragraph of applicant's remarks). Thus, the shape is not deemed to be a decisive factor, if any, for the shifting phenomena. Further, as it is stated supra the electric current flows through the stainless steel will be minimum. Thus, the loss will also be minimum. Accordingly, it is expected that a shifting of metal particles occurs in Vives.

g. In page 11, last paragraph of the remarks applicant stated that in the process of Radjai the silicon carbide particles is added to the molten metal and the particles of the instant application is smaller than that of Radjai. However, applicant did not provide any evidence for supporting the allegation. Radjai et al. states that "suspended silicon particles multiplied in number with a reduction in size by vibrations at temperatures higher than the liquidus and agglomerated and **repelled to the outer surface** after the start of solidification." Thus, Radjai et al. starts to apply the vibrations at the temperature higher than the liquidus and **shift**

the particles to the **outer surface** during solidification process. Applicant further stated that Radjai et al. do not apply an alternating current and a magnetic field simultaneously at a current value and a Tesla value configured to crush solid crystal particles of the solidifying metallic material into small pieces. However, in last two lines of Radjai et al. it states that "metallographic observations showed that the cavitation phenomenon was a main responsible for the **crushing of the suspended silicon particles.**" Thus, applicant's argument is not deemed to be persuasive.

h. For sake of argument, even if Radjai does add particles to the molten metal and the particles are agglomerated and repelled to the periphery of the vessel, the solid crystal particles precipitated out from the solidifying liquid alloy will also be crushed by the cavitation phenomenon generated by the electromagnetic vibrations and will also experience the pinching force. Since the scope of the claim does not exclude the addition of particles to the melt, the claimed invention does not define over Radjai. It is further noted that in pages 7, 2nd paragraph, page 10, 2nd and 4th paragraphs of the instant specification applicant also add particles to the solidifying melt. Thus, applicant's argument is moot.

7. All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE**

FINAL even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kuang Y. Lin whose telephone number is 571-272-1179. The examiner can normally be reached on Monday-Friday, 10:00-6:30,.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kuang Y. Lin
Primary Examiner
Art Unit 1725

7-12-07